

# PATENT SPECIFICATION

DRAWINGS ATTACHED

1,127,291

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Date of filing Complete Specification: 16 November, 1965.

Application Date: 5 October, 1964.

No. 40400/64

Complete Specification Published: 18 September, 1968.

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Index at Acceptance:—F1 A (1A1A, 2A2A, 3G4A, 3J, 3X8, 4L, 4M, 4V, 4W).

Int. Cl.:—F 04 b 1/20.

## COMPLETE SPECIFICATION

### Axial Piston Pumps

We, JOSEPH LUCAS (INDUSTRIES) LIMITED, of Great King Street, in the City of Birmingham 19, a British Company, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to liquid pumps of the kind comprising a body, a rotor mounted in the body, a driving shaft whereby the rotor is rotated within the body, a plurality of plungers disposed in respective bores in the rotor, a cam plate non-rotatably mounted in the body against which the plungers bear, said cam plate being inclined to the axis of rotation of the rotor to reciprocate the plungers as the rotor rotates, and there being inlet and outlet passages for liquid respectively, communicating in turn with the bores as the rotor rotates.

The object of the invention is to provide a pump of the kind specified, in a convenient form.

According to the present invention a liquid pump of the kind specified is characterised by the feature that the driving shaft is tubular and the bore thereof forms at least part of an outlet passage for liquid from the pump.

The invention will now be described with reference to the accompanying drawings in which the single figure is a cross-sectional side elevation view of a pump constructed in accordance with this invention.

In this example there is provided a liquid pump particularly for use in a self propelled underwater torpedo. The pump is intended to provide a supply of sea water to a condenser chamber into which the exhaust gases from an internal com-

bustion engine for driving a propeller of the torpedo, are ducted. The water and condensate are then pumped out of the chamber and discharged into the sea, preferably through the propeller hub.

The pump comprises a body 10 which is secured inside the torpedo casing (not shown), the body 10 containing a rotor 11 which is concentric with and is driven by the propeller shaft from the engine a separate section of the shaft being indicated by 12.

The rotor has a plurality of bores 13, 14 arranged in two concentric rows, the bores containing respective plungers 15, 16 carrying slippers 17, 18 the plungers 15, 16 being reciprocated in the rotor 11 by contact with a non-rotatable cam plate 19 mounted in the body 10 and inclined to the axis of rotation of the rotor 11. The bores 13, 14 and plungers 15, 16, or at least those of the outer row are so formed that there are virtually no portions of the bores which are not swept by the respective plungers. The double row of plungers in a pump of this type forms the subject of our copending British Patent Application No. 40401/64 (Serial No. 1127292).

At its end remote from the cam plate 19, the rotor 11 bears against a ported member 20 in the body 10 in which are formed a plurality of ports (not shown) which communicate with the bores 13, 14 in turn as the rotor 11 rotates.

The ports communicate with respective chambers defined between the ported member 20 and the body 10, these chambers forming passages of which there are two sets of inlet passages and two sets of outlet passages. A first inlet passage is in communication with an opening in the wall of the torpedo casing (not shown) for the entry of sea water to the bores 13 of

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the inner row. A first outlet passage communicates with these inner bores 13 through the ports in the ported member 20, and serve to deliver sea water to the condenser chamber.

A second inlet passage affords communication between the condenser chamber and the outer row of bores 14 and the second outlet passage comprises an internal annular recess 21 in the ported member 20 to deliver the water and condensate to the interior of the propeller shaft 12 which is tubular for this purpose. Communication with the interior of this shaft 12 is through a plurality of holes 22 in the wall of the tubular shaft 12.

Between the second inlet and the second outlet there is a non-return pressure relief valve indicated generally at 23 which thus by-passes the condensate pumping portion of the pump constituted by the outer row of bores 14 and plungers 16.

The rubbing surfaces of the pump may have linings of a material which is satisfactorily lubricated by sea water. An ex-

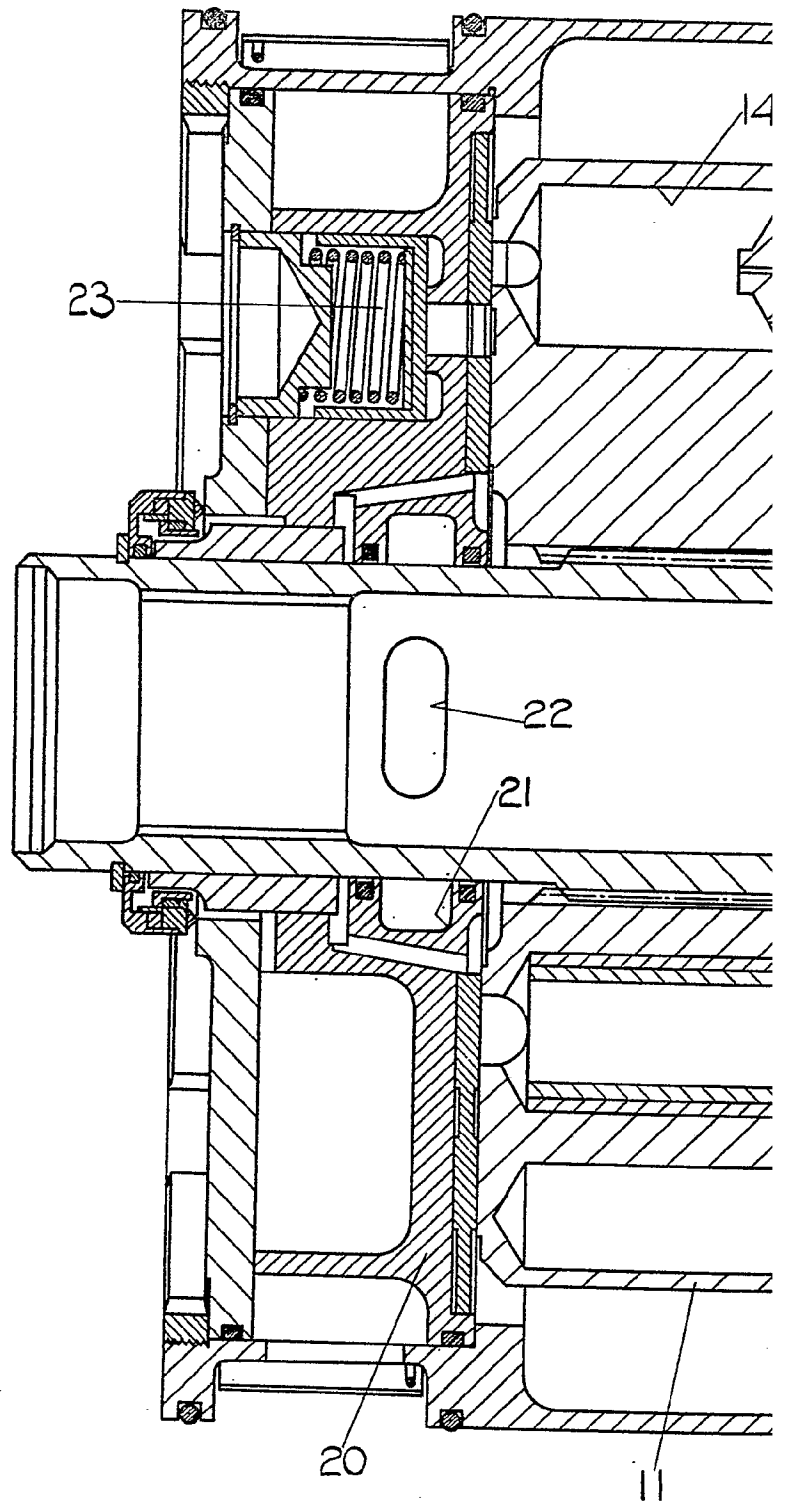
ample is a resin bonded fibre material, such as that known by the Registered Trade Mark "Orkot". This forms the subject of our co-pending British Patent Application No. 41236/64 (Serial No. 1127293) which is an application for a Patent of Addition to our Patent Application No. 39049/63 (Serial No. 1,060,004) and entitled "Fluid Pumps or Motors".

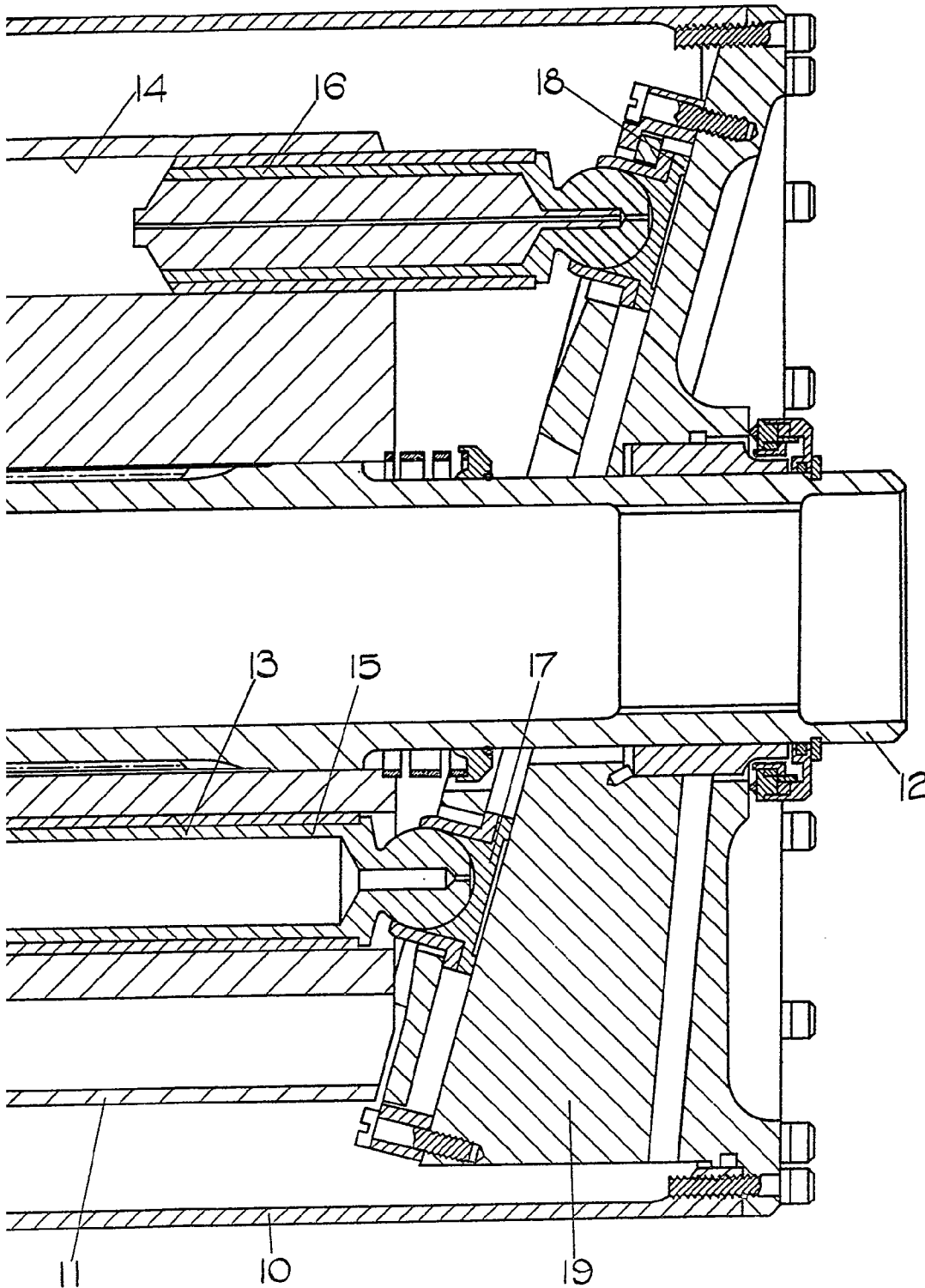
#### WHAT WE CLAIM IS:—

1. A liquid pump of the kind specified characterised by the feature that the driving shaft is tubular and the bore thereof forms at least part of an outlet passage for liquid from the pump.

2. A liquid pump as claimed in claim 1 in which the rotor has two rows of bores containing plungers, separate inlets and outlets being associated with the rows respectively and the outlet associated with one of the rows being arranged to communicate with the bore of the shaft.

MARKS & CLERK,  
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1,127,291 COMPLETE SPECIFICATION  
1 SHEET  
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